

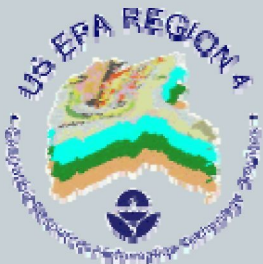
**BRIEFING
TECHNICAL PAPER
OFFICE OF SUPERFUND REMEDIATION AND
TECHNOLOGY INNOVATION
EPA, REGION 4**

**Florida Phosphate Mine Initiative
Region 4, Superfund Division**

February 28, 2008



U.S. Environmental Protection Agency



PURPOSE

- Proposed strategy for assessing phosphate mine related CERCLIS sites
- Review Region 4's criteria for addressing TENORM at phosphate mining sites
- Summarize coordination efforts among EPA HQ, ASTDR, FDEP, and FDOH

OUTLINE

- 1.0 Purpose of Technical Paper
- 2.0 Phosphate Mining in Florida
- 3.0 Potentially Affected Area
 - 3.1 Exposure Pathways
 - 3.2 Potentially Affected Population
- 4.0 Authorities to Address Phosphate Mining and Contamination Associated with Phosphate Mining
 - 4.1 Federal Authorities
 - 4.2 State Authorities
 - 4.3 Local Authorities
- 5.0 History of Federal and State Actions and Coordination
- 6.0 Assessment and Evaluation Criteria
- 7.0 Proposed TENORM Assessment Strategy

POTENTIALLY AFFECTED AREA

- 23 CERCLIS sites that total approximately 337 square miles in size
- 2 square miles of residential development associated with CERCLIS sites
- Additional developed and undeveloped areas beyond the scope of this project

ASSESSMENT & EVALUATION CRITERIA

- 5 pCi/g above background for Ra^{226} in soil (Source: UMTRCA) (background: 1 pCi/g)
- 5 pCi/l for Ra^{226} in groundwater (Source: MCL) (background: < 2 pCi/l)
- 20 $\mu\text{r/hr}$ above background for direct gamma radiation (Source: UMTRCA) (background: 6 $\mu\text{r/hr}$)

PARTNER AGENCY FEEDBACK ON PHOSPHATE INITIATIVE

- EPA HQ (OSWER, ORA, OECA)
 - Guidance on assessment and cleanup of radiation sites under Superfund
 - Guidance on assessment and cleanup criteria used by other programs
- ATSDR
 - Defined “Observable health effects” versus “potential risk”
 - Advised on protectiveness; does not set cleanup level
 - Observable health effects level based on “minimum risk level”
 - MRL of 100 mRem/yr for radiation corresponds to approximately 10^{-3} risk level
 - Determined EPA criteria protective, but could be higher
 - Concurred with EPA’s proposed radiation assessment strategy
- State
 - Provided GIS support in identification and location of phosphate mines
 - Provided insight into phosphate mining industry and role of state in regulating the industry
 - FDOH proposed tiered assessment and cleanup approach based on radiation levels less than 100 mRem/yr, 100 to 500 mRem/yr, and greater than 500 mRem/yr

PROPOSED STRATEGY

- Develop and implement communication strategy in coordination with EPA HQ, ATSDR and State
- Conduct aerial radiation survey of 23 phosphate mine related CERCLIS sites
- Conduct ground-based characterization at individual sites guided by data from aerial survey
- Issue Expanded Site Inspection (ESI) reports and document decisions in CERCLIS
- Evaluate PRP involvement for ESIs at individual sites

SCHEDULE

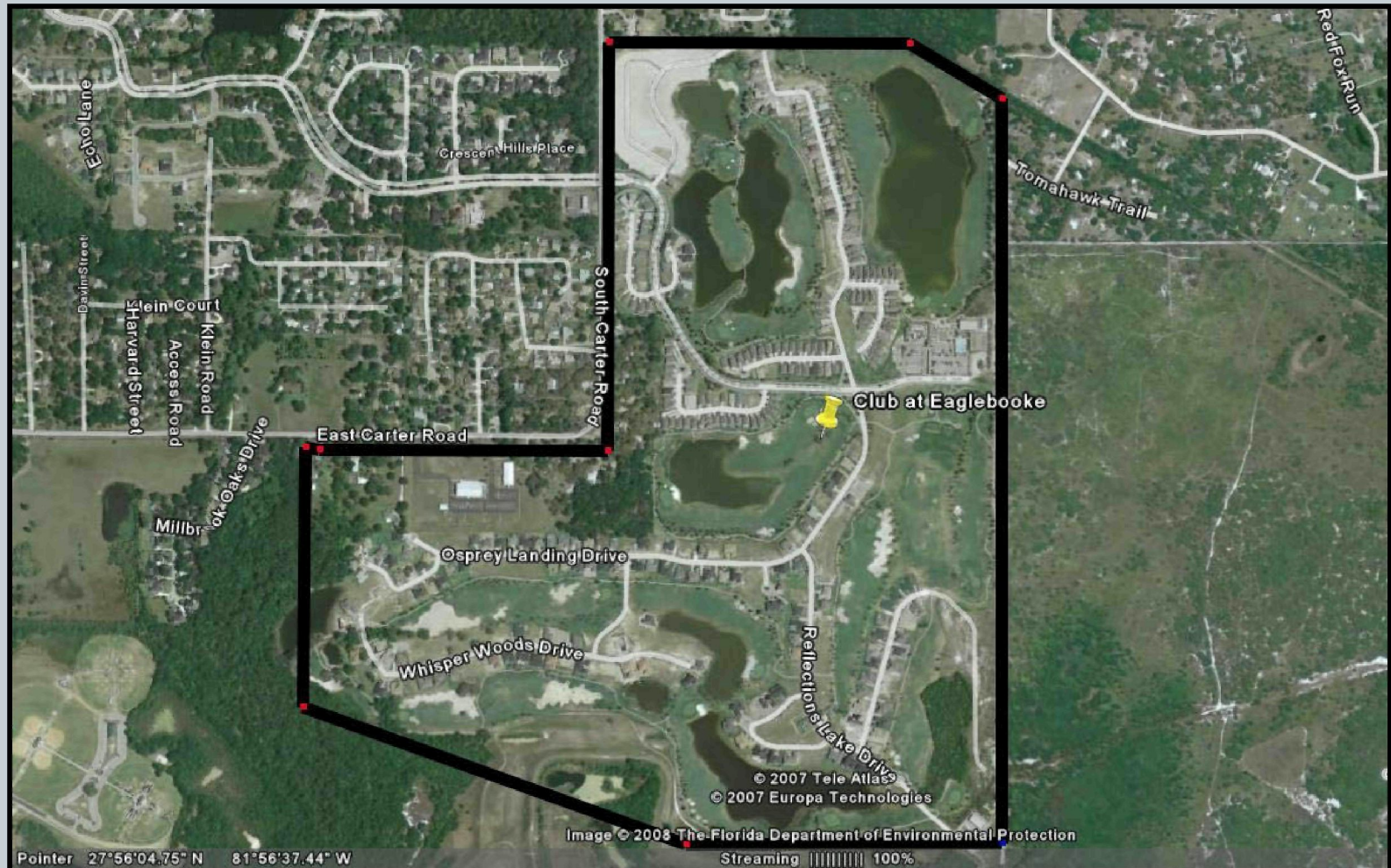
- Survey contractor's draft Work Plan completed (12/07)
- Draft communication strategy completed (12/07)
- EPA Regional Senior Management meeting February 2008
- Office of Superfund Remediation and Technology briefing February 2008
- RA Briefing of Administrator March 2008 (?)
- Governor's staff briefing (?)
- Approve WP and CI strategy March 2008
- Press release issued early-April 2008
- Radiation Survey April through June 2008
- Report September 2008

NEXT STEPS

- Formal project approval needed March 2008, based on current schedule
- Obligate project funding March 2008

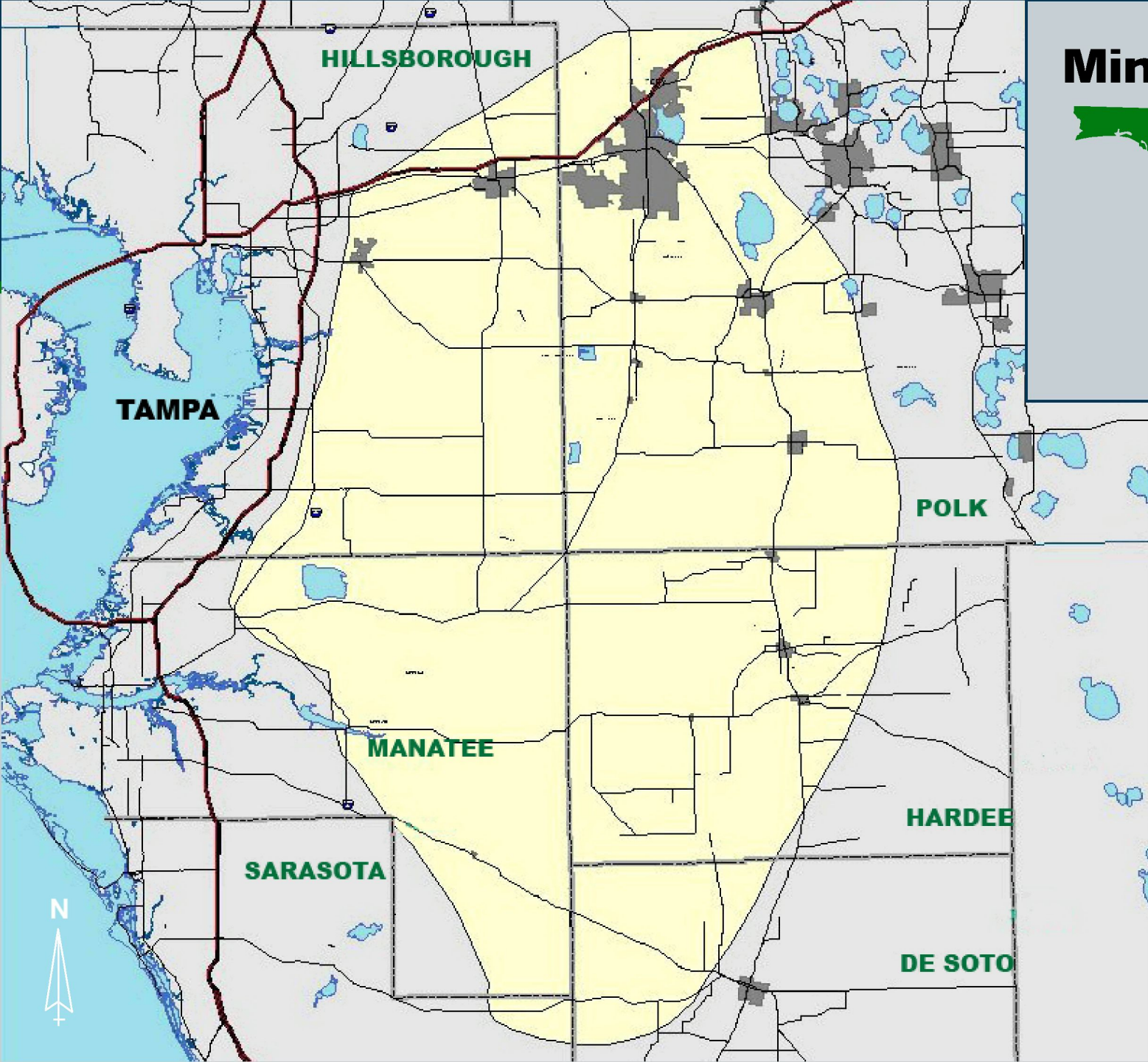
SUPPLEMENTAL INFORMATION

RESIDENTIAL DEVELOPMENT OVERLYING CERCLIS SITE

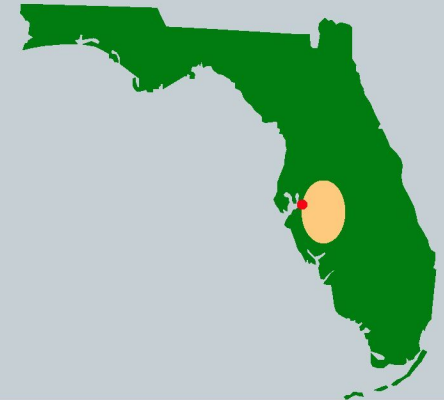


BACKGROUND

- Phosphate Mining conducted in West-Central Florida since late the 1800's.
- Waste by-products contaminated with elevated levels of Radium and Uranium (TENORM).
- State regulates mine operations and reclamation, but not radionuclides.
- Formerly mined land frequently developed for residential use, potentially increasing annual doses of radiation.
- 21 former mine sites in EPA inventory awaiting further characterization.
- Approximately 7,000 acres of residential areas currently located over former mines.
- EPA and State radiation data indicate potential for increases in cancer (1×10^{-3} to 1×10^{-2}) due to increase exposure to radiation.



Mining Area



Legend

- Interstates
- County Line
- Towns
- Water Bodies
- Mineable Limit
- Counties

TYPICAL MINING AREAS

Active Mining Area



Pre- & Post-Mined Area



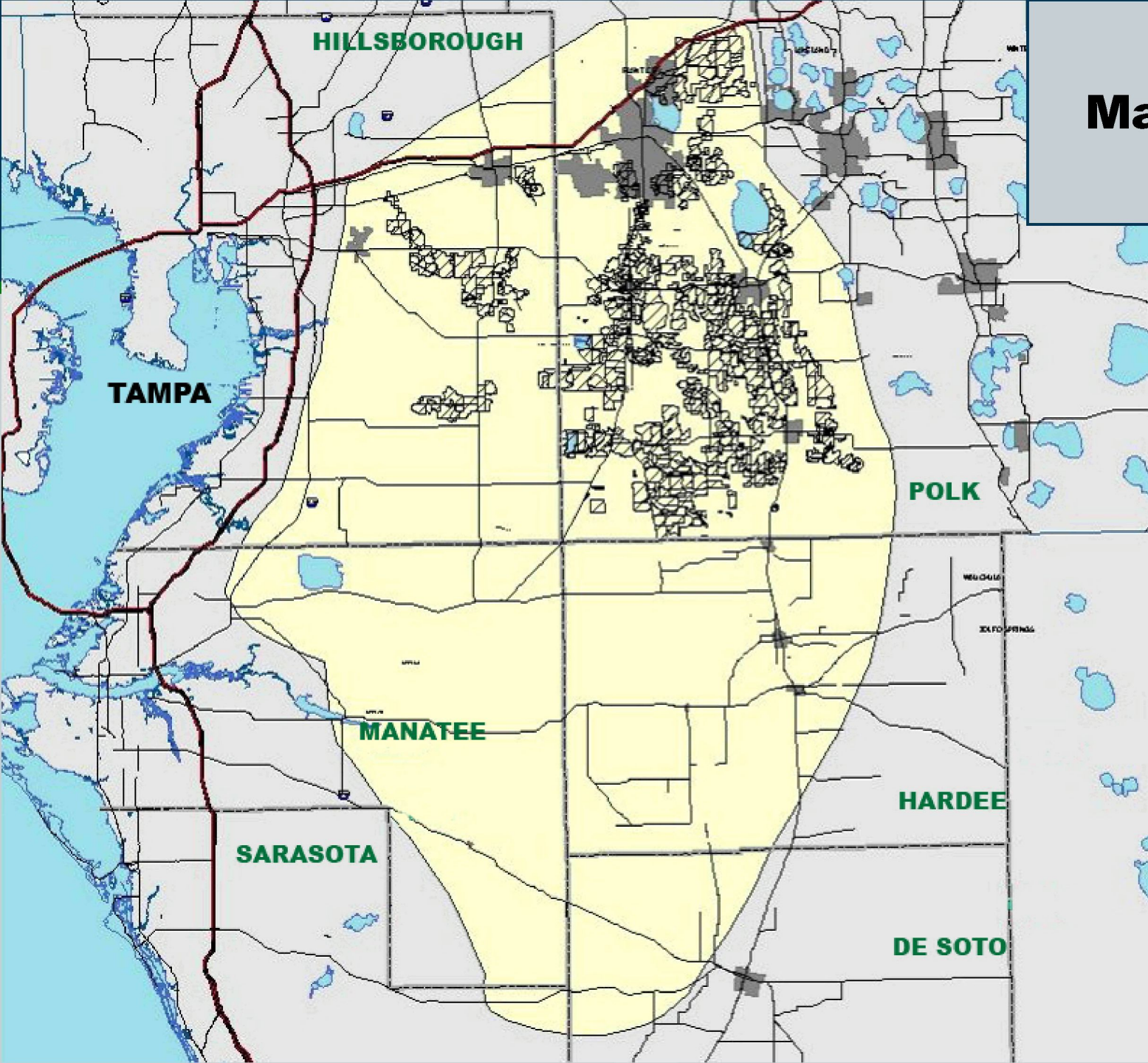
Settling Ponds



Gypsum Stack



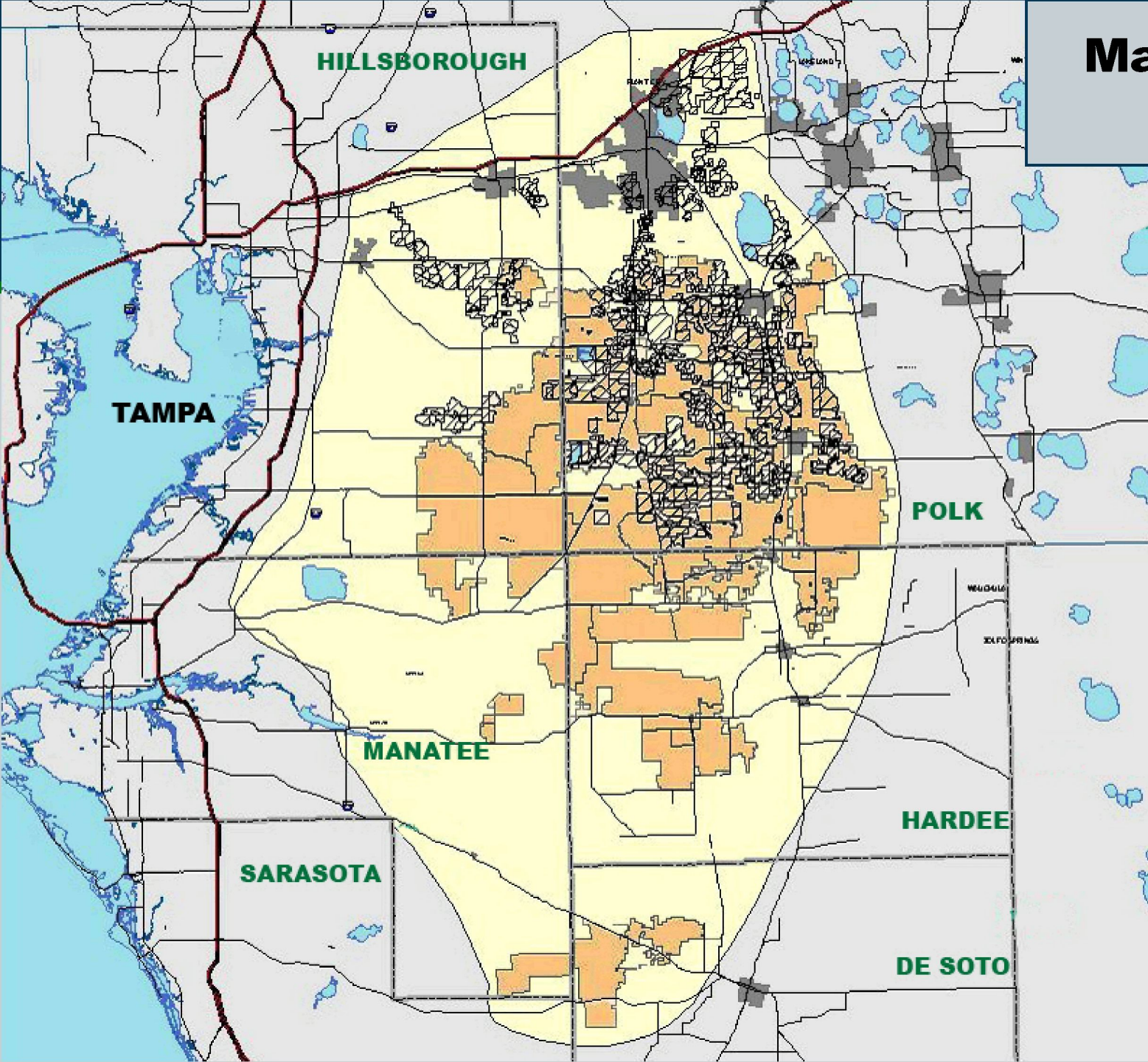
Non-Mandatory Sites



Legend

- Interstates
- County Line
- Nonmandatory
- Towns
- Water Bodies
- Mineable Limit
- Counties

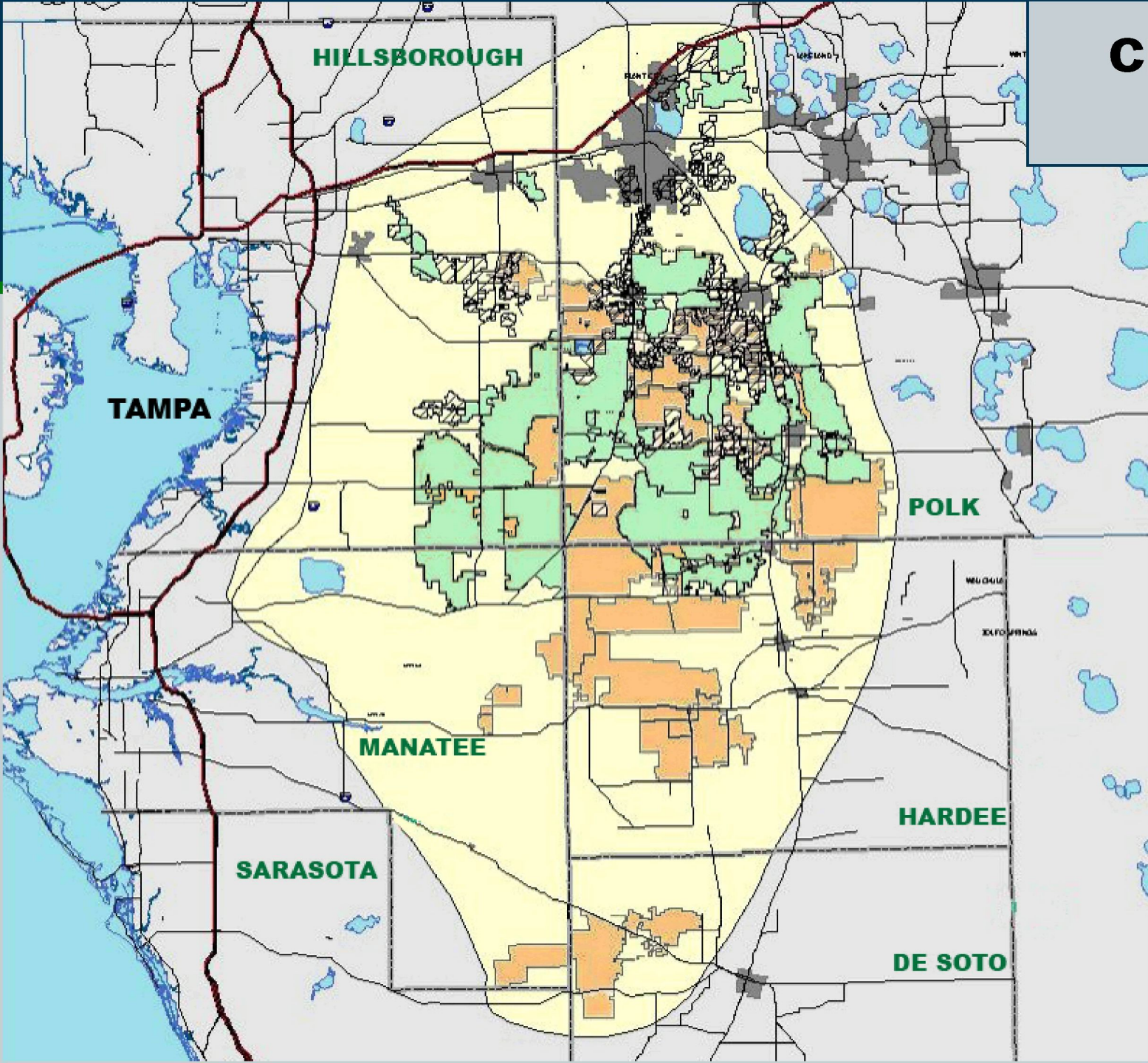
Mandatory Sites



Legend

- Interstates
- County Line
- Nonmandatory
- Towns
- Water Bodies
- Mandatory Mines
- Mineable Limit
- Counties

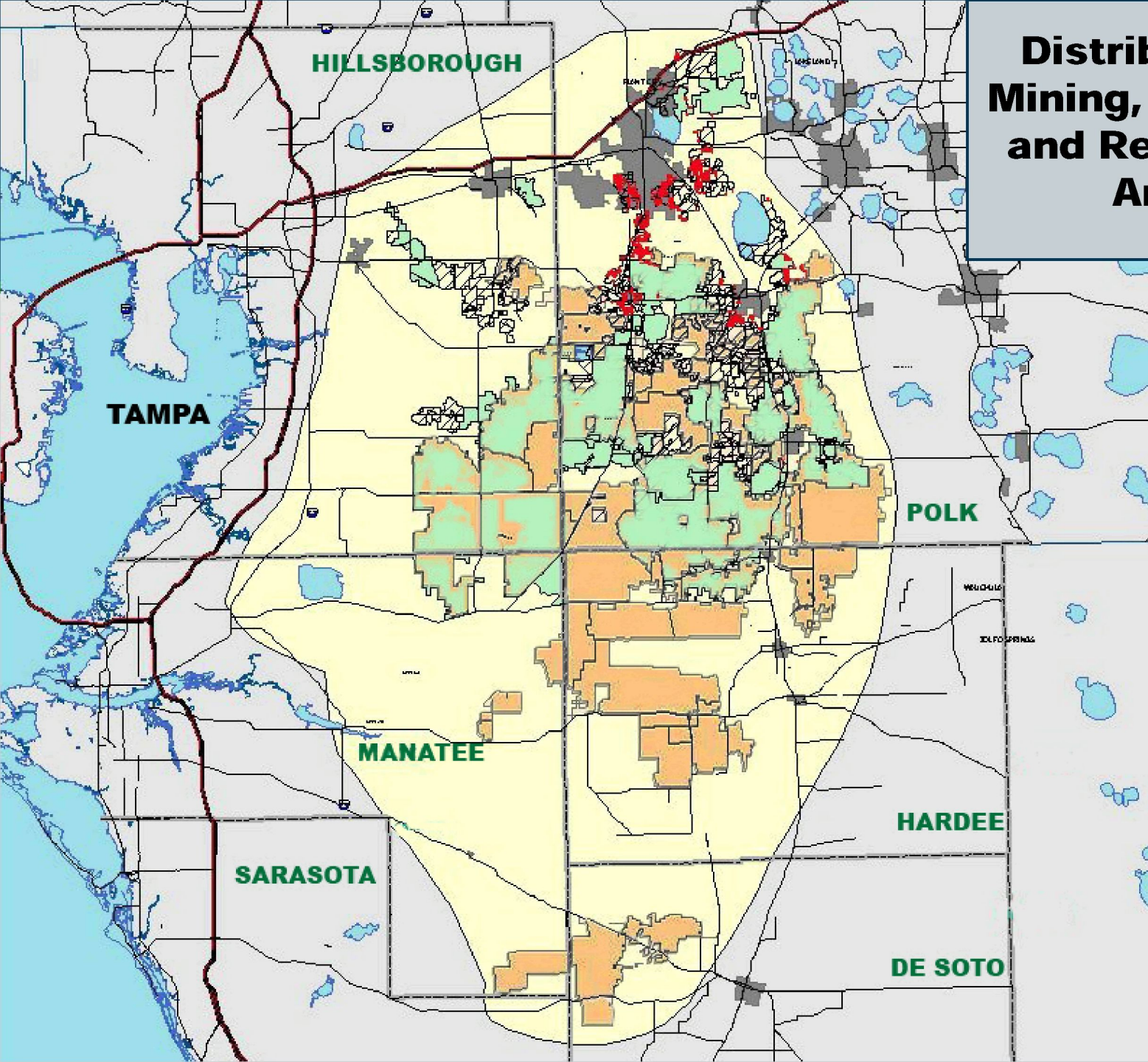
CERCLIS Sites



Legend

- Interstates
- County Line
- Cerolis Mining Sites
- Nonmandatory
- Towns
- Water Bodies
- Mandatory Mines
- Mineable Limit
- Counties

Distribution of Mining, CERCLIS, and Residential Areas

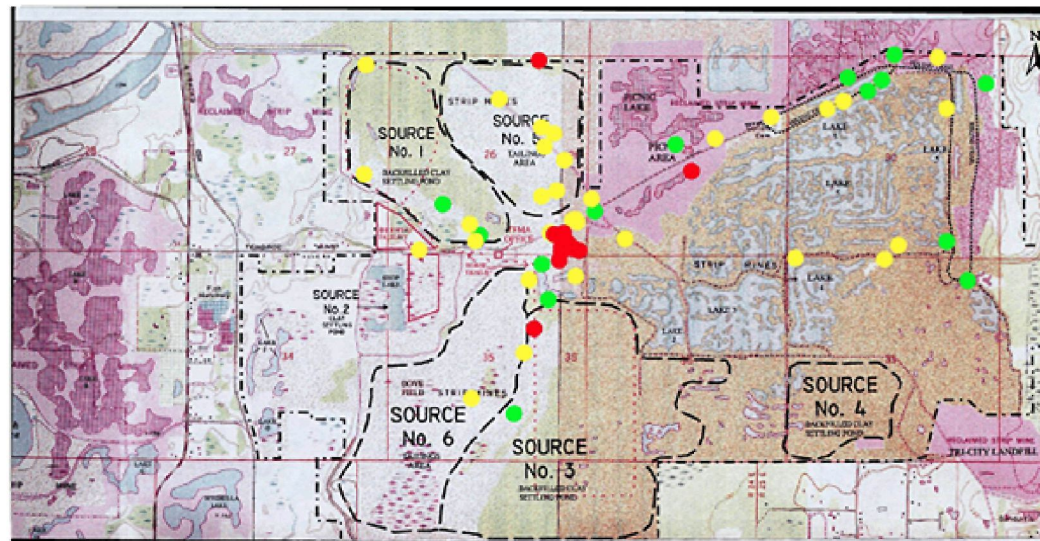


Legend

- All Mines Intersection
- Cerclis Intersection
- Nonmandatory
- Interstates
- County Line
- Cerclis Mining Sites
- Nonmandatory
- Towns
- Water Bodies
- Mandatory Mines
- Mineable Limit
- Counties

EPA RADIATION DATA UNDEVELOPED MINE

BORDEN CHEMICAL COMPANY / TENOROC MINE RADIATION MEASUREMENT LOCATIONS



Legend

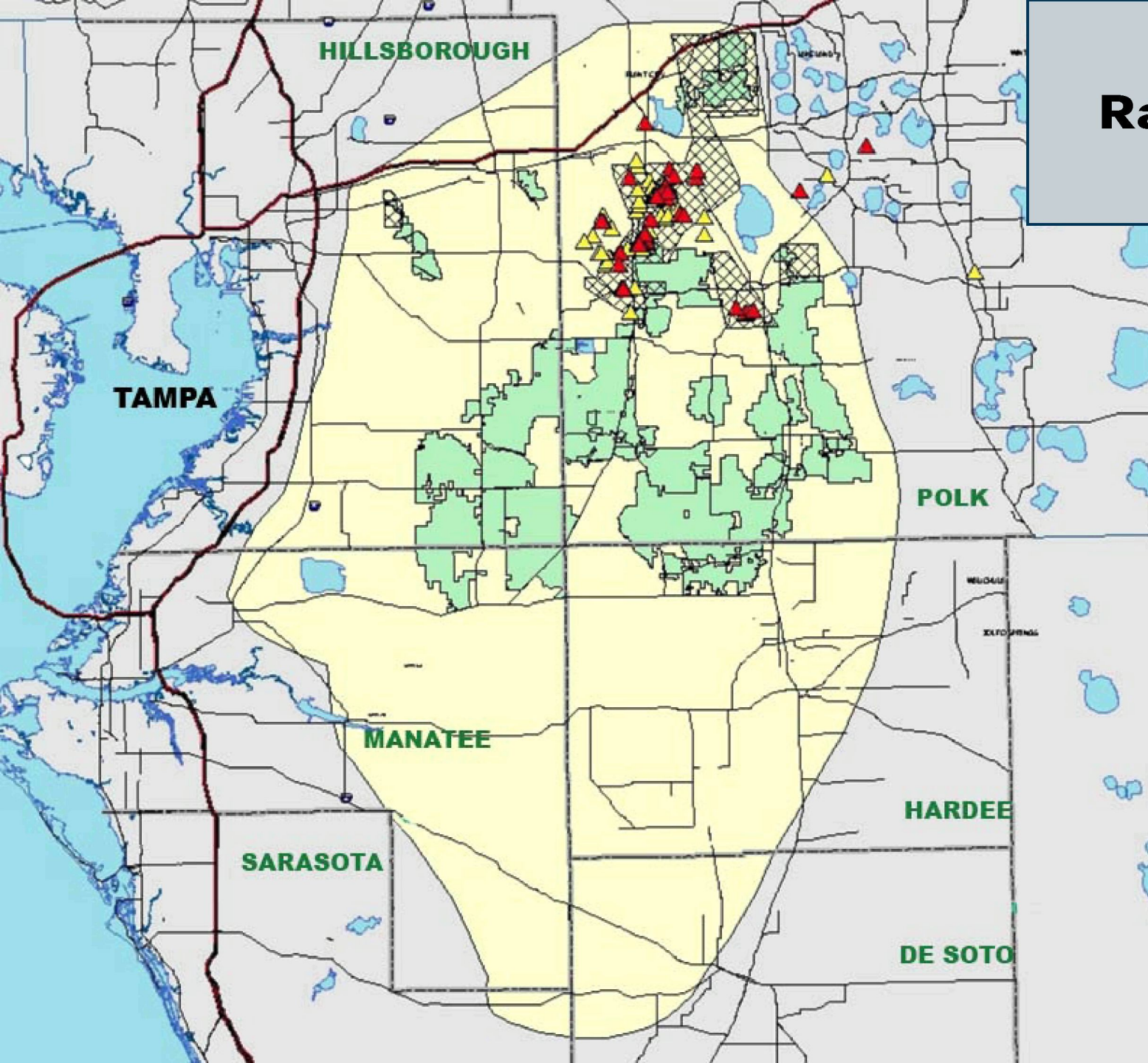
- < 15 mRem/yr
- > 15 and < 100 mRem/yr
- > 100 and < 500 mRem/yr
- > 500 mRem/yr
- Site Boundaries
- Source Areas

Map Scale



This map is an adaptation of Fig. 1 in the report of July 25, 2009 prepared for the U.S. EPA by Tetra Tech TM Inc.

State Radiation Data



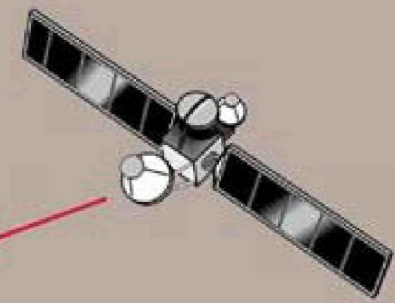
Legend

- Interstate
- County Line
- Order Mining Sites
- Survey Area
- Water Bodies
- Mineral Unill
- County
- Order Mining Sites
- reshill
- Yellow Triangle: No Further Action
- Red Triangle: Further Action Indicated



**REDAR V
&
Airborne
GPS**

**GPS/Differential
Antenna**

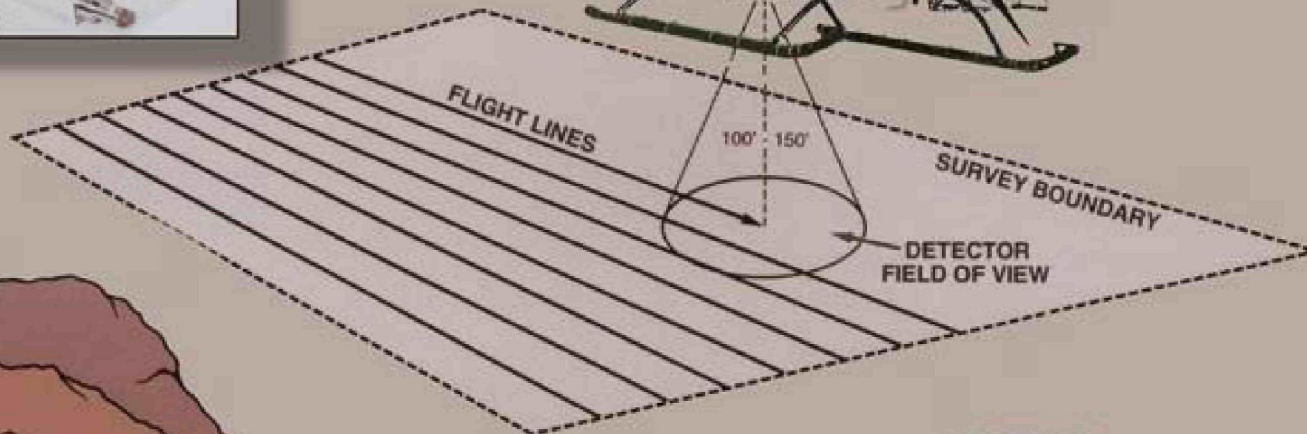


NaI DETECTOR

**Detector
Pod**



**Steering
Indicator**



Radiation Survey Method

CURRENT PHOSPHATE MINING COMPANIES & CURRENT/FORMER OWNERS OF SAMPLING OF CERCLIS SITES AND DEVELOPED AREA

- **CURRENT MINING COMPANIES**

- CF INDUSTRIES (MID-WESTERN CO-OP)
- MOASIC (FORMERLY CARGILL AND AGRICO)
- PCS PHOSPHATE (CANADIAN COMPANY)
- USAC (CHINA BASED COMPANY)

- **CERCLIS SITES CURRENT/PAST OWNERS/OPERATORS**

- AGRICO; WR GRACE; IMC; CARGILL; AMERICAN CYANAMID; KERR-MCGEE; SEMINOLE FERT.; AMAX; CORONET; BORDEN; FARM LAND IND; ESTECH; SWIFT AGRICULTURAL

- **CHRISTINA BLUFFS RESIDENTIAL AREA**

- W.R. GRACE ORIGINAL OWNER
- MULTIPLE INDIVIDUAL AND BUSINESS OWNERS
- CURRENTLY OWNED BY INDIVIDUAL RESIDENTS